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ABSTRACT

Social scientists with an interest in education policy have devoted a great deal of time in recent years to assessing if the level of per pupil school expenditures is related to any outputs of formal education that are valued by our society. In this paper we develop several alternative models for the purpose of estimating the effects of per pupil school expenditures on future earnings, and on the basis of these estimates we calculate a range of rates of return to expenditures. After a brief review of the literature, we describe our data, develop the models, and the present and discuss the empirical results. Most of the data comes from the University of Michigan Survey Research Center's Income Dynamics Panel. This survey contains information for the five years from 1968 through 1972. The study uses only male respondents who are between the ages of 30 and 55 in 1972. The Michigan Survey has such data as annual and hourly earnings for five years, years of schooling, age, race, and father's years of schooling. Researcher also obtained data from the 1930, 1940, 1950, and 1960 U.S. Censuses of Population on per pupil expenditures and per capita income by state. From 1930, 1940, and 1960 Biennial Surveys of Education, researchers obtained per pupil school expenditures by race for the 17 Southern states with separate school systems prior to 1954. (Author/JM)

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ECONOMIC RETURNS TO EDUCATION QUALITY: AN EMPIRICAL ANALYSIS FOR WHITES, BLACKS, POOR WHITES, AND POOR BLACKS

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ABSTRACT

The extent to which higher per pupil school expenditures leads to any desireable outputs is an important policy question. In this paper we develop several alternative models which relate per pupil school expenditures to achievement orientation, verbal ability, years of schooling, and earnings. Our results indicate that the rate of return to per pupil school expenditures is quite respectable for whites irrespective of the model used, and, depending upon the model, equally respectable or negative for poor whites. For all blacks and just poor blacks, irrespective of the model, the rate of return to increased per pupil school expenditures is quite high.

ECONOMIC RETURNS TO EDUCATION QUALITY: AN EMPIRICAL ANALYSIS FOR WHITES, BLACKS, POOR WHITES, AND POOR BLACKS

I. INTRODUCTION

Social scientists with an interest in education policy have devoted a great deal of time in recent years to assessing if the level of per pupil school expenditures is related to any outputs of formal education that are valued by our society. In this paper we develop several alternative models for the purpose of estimating the effects of per pupil school expenditures on future earnings, and on the basis of these estimates we calculate a range of rates of return to school expenditures. After a brief review of the literature, we describe our data, develop the models, and then present and discuss the empirical results.

Most of the previous studies, like the Coleman Report, have examined the relationship between school expenditures and achievement test scores. From an economist's point of view, however, formal education is a method of accumulating human capital; the output of interest, therefore, is the income flow generated by formal education. Unless it is assumed that cognitive development is the only school output that affects future earnings and that achievement test scores measure <u>all</u> cognitive development that affects future earnings, it is impossible to generalize from the relationship between school expenditures and achievement test scores to the relationship between school expenditures and future earnings. Obviously, these necessary assumptions are very strong. Formal education performs socializing functions, such as instilling--to a greater or lesser

degree--good work habits and a value system oriented toward economic achievement. Both the work habits and the value system are likely to affect future earnings. Similarly, the quality of an individual's education may affect his self-confidence, which in turn is likely to affect his future economic success. Finally, there are many kinds of academic and vocational skills, such as proficiency in foreign languages or typing, that an individual gains from formal education that are not reflected in achievement test scores.[1]

Three more recent studies--by Johnson and Stafford [1973], Ribich and Murphy [1973], and Morgenstern [1973]--have attempted to estimate the relationship between school expenditures and future earnings. The latter two found little or no relationship. But they are based on samples that are likely to produce biased and/or unreliable estimates. The Morgenstern sample is drawn from 15 large, mostly Northern cities.[2] To each observation in the sample, Morgenstern attaches the average per pupil expenditure of the state in which the individual grew up. In his sample, therefore, the individuals who are likely to have lowest per pupil expenditures are those who grew up in the South, because per pupil expenditures in the South have been much lower than those in other areas. But if, as many studies suggest, those who have migrated to the North are more able than the average nonmigrant,[3] then ability will be negatively correlated with school expenditures in Morgenstern's sample. In the absence of a variable to control for ability, his school expenditure coefficient will be negatively biased.

The Ribich-Murphy study is based on the Project Talent survey data. Unfortunately, due primarily to nonresponse, their sample consists of

less than 20 percent of the original Project Talent male sample. Moreover, data on individual earnings and occupation were obtained only five years after scheduled high school graduation. At this age a single year's earnings and occupation are likely to be fairly inaccurate proxies for future earnings. The errors could quite easily be systematically related to quality of education. For example, those with higher quality education could get jobs with more on-the-job training and, hence, initially lower wage rates.

The Johnson-Stafford study, which uses the same methodology as Morgenstern but is based on a national survey, found a very strong relationship between average per pupil school expenditures in the state in which the individual grew up and his future earnings. But they do not attempt to investigate the possibility that per pupil school expenditures are a proxy for some other factor about the state in which the individual grew up--e.g., income--that leads to higher earnings. Moreover, they treat the question of whether or not earnings should be deflated by a cost-of-living index in a very ad hoc fashion.

Our study builds on the work of Morgenstern, Ribich and Murphy, and particularly Johnson and Stafford. It is based on better data than was available to any of the previous researchers. Our models are more sophisticated, and we systematically examine the sensitivity of our results to equally plausible alternative models.

II. DATA

Most of our data comes from the University of Michigan Survey Research Center's Income Dynamics Panel. This survey contains information for the

five years from 1968 through 1972. We use only male respondents who are between the ages of 30 and 55 in 1972. While these ages are admittedly arbitrary, they contain observations on the prime working years without including a great number of observations of either students or retirees. Men with zero earnings and those who are self-employed are excluded from the sample.[4] Our final sample size is 1049, of which 716 are white, 333 are black, 315 are white and poor, and 218 are black and poor.[5]

The Michigan Survey has data on annual and hourly earnings for five years, years of schooling, age, race, father's years of schooling, father's occupation, parent's income class, respondent's number of siblings, the state in which the individual grew up, the degree of urbanization of the area in which he grew up, an estimate of the wage rate paid to unskilled labor in the local area in which the individual lives, a Bureau of Labor cost-of-living index for that area, the population of that area,[6] and scores on a short answer, verbal ability test and an achievement orientation index. The verbal ability and achievement orientation questionnaires were administered during the fifth year of the Survey.[7]

In addition to the data obtained from the Michigan Survey, we obtained data from the 1930, 1940, 1950, and 1960 U.S. Censuses of Population on per pupil expenditures and per capita income by state. From 1930, 1940, and 1950 Biennial Surveys of Education, we obtained per pupil school expenditures by race for the seventeen Southern states with separate school systems prior to 1954. Values for these data during intercensal years were obtained by straight-line interpolation. Each individual in the sample was then assigned the per pupil school expenditure and per capita income figure for the state in which he lived when he was 12 years old. The

measure of parent's income class in the Michigan data is crude. Respondents were asked if their parents were poor, middle income, or upper income. Fifty percent said their parents were poor. Consequently, in addition to this measure we used the occupation of the respondent's father to create a more continuous and refined measure of parent's income. The income figure assigned was taken from the median earnings of the 10 occupation categories as reported in the 1950 Census.

All monetary variables are deflated both over time and cross-sectionally by cost-of-living indices. The U.S. Department of Commerce cost-of-living index was used to inflate all variables to 1972 dollar terms. A 1960 state cost-of-living index developed by John Bishop was used to deflate the state per pupil expenditure and per capita income variables as well as the father's income variable.[8] (We assume that the relative costs of living among states was reasonably stable between 1930 and 1960.) Finally, as explained below, we deflate earnings in one set of regressions by a Bureau of Labor current cost-of-living index while in other regressions we do not deflate earnings by any cost-of-living index.

III. THE BASIC MODEL

The basic model (Model I) consists of a recursive system of four equations. This system allows us to analyze indirect as well as direct effects of various factors on earnings. The conceptual framework underlying the model comes from human capital theory. The general formulation of the basic model follows, along with an equation by equation discussion of the rationale for the variables included.

Basic Model

$$(1)\quad ACHIEVE = a_0 + a_1 LNSCHEXP + a_2 FATHINC + a_4 MIDINC + a_5 UPINC + a_6 SIBS + a_7 FARMER$$

$$(2)\quad VERAB = b_0 + b_1 LNSCHEXP + b_2 ACHIEVE + b_3 FATHED + b_4 FATHINC + b_5 MIDINC + b_6 SIBS + b_7 FARMER + b_8 AGE$$

$$(3)\quad EDYEARS = c_0 + c_1 LNSCHEXP + c_2 ACHIEVE + c_3 VERAB + c_4 FATHED + c_5 FATHINC + c_6 MIDINC + c_7 UPINC + c_8 SIBS + c_9 FARMER + c_{10} CITY + c_{11} AGE$$

$$(4)\quad LNAVWR = d_0 + d_1 LNSCHEXP + d_2 VERAB + d_3 ACHIEVE + d_4 EDYEARS + d_5 FATHED + d_6 FATHINC + d_7 MIDINC + d_8 UPINC + d_9 FARMER + d_{10} CITY + d_{11} EXPER + d_{12} EXPER^2 + d_{13} EDEXP$$

where

ACHIEVE = the respondent's score on an achievement orientation scale

LNSCHEXP = the natural logarithm of average school expenditures in the state where the respondent grew up

FATHED = years of schooling completed by the respondent's father

FATHINC = an estimate of respondent's father's income based on the father's occupation

MIDINC = a zero-one dichotomous variable equal to one if the respondent classified his parent's income level as middle income

UPINC = a zero-one dichotomous variable equal to one if the respondent classified his parent's income as upper income

SIBS = respondent's number of siblings

FARMER = a zero-one dichotomous variable equal to one if the respondent's father owned and operated a farm for a living

VERAB = the respondent's score on a 13-sentence completion, verbal ability test

CITY = a zero-one dichotomous variable equal to one if the respondent grew up in a city

AGE = age of respondent

EDYEARS = years of schooling completed by respondent[9]

LYAVWR = the natural logarithm of the respondent's 5-year average hourly wage rate

EXPER = potential years of labor force experience defined as [age-(years of schooling + 6)]

$EXPER^2$ = the product of EXPER and EXPER

EDEXP = the product of EDYEARS and EXPER

A variant of Model I involves two changes in equation (4). The dependent variable is LNAVEARN (the log of the respondent's 5-year average annual earnings). In addition, a variable measuring the average annual number of weeks of work missed during the 5 years due to illness (WKSICK) is added to the equation. The parameters of each model are estimated separately for four specific populations: Total White, Total Black, Poor White, and Poor Black.[10]

A. Achievement Orientation

Values or attitudes such as motivation or achievement orientation are mainly a product of socialization. Both home and school influence can be expected to affect these attitudes. To the extent that motivation or achievement orientation leads to greater economic success, high-income parents are more likely than lower-income parents to possess these values, and to pass them on to their children. (The relationship would be positive even if causation went the other way--i.e., if economic success led to the adoption of an achievement orientation value system.)[11] In addition, other things being equal, the more income the parents have, the more time they are able to invest in socializing their children in what

they consider to be desirable values. Similarly, the smaller the number of siblings, the more time per child can the parents devote to socialization.

Most of the variables in equation (1) are designed to measure parents' income. Because farmers derive a large share of their total real income from in-kind income, the income figure derived from father's occupation is too low for farmers. Consequently, we add a dummy variable for respondents whose fathers were farmers. The father's education variable is also a proxy for income, and to some extent, is an independent measure of success in terms of status.

Socialization is a very important function of the schools. Quality of schooling as measured by per pupil school expenditures, therefore, should have a positive effect on motivation. Because achievement orientation is such a prominent value in our society, it is reasonable to expect that most schools try to inculcate it in their students. Moreover, not only is it reasonable to expect that better schools will do a more thorough job of socialization, but it is also probable that in schools with lower pupil-teacher ratios--an important element in per pupil expenditures--teachers have more time to devote to enhancing the confidence of marginal students and to making them more amenable to an achievement-oriented value system.

B. Verbal Ability

We hypothesize that verbal ability--like motivation--can be affected both by family background variables and by the quality of schooling. There are two reasons--heredity and environment--for expecting the income and education variables to be positively related to verbal ability. Other things

being equal, individuals with high verbal ability are more likely than individuals with low verbal ability to achieve economic success. Upper-income families are, therefore, apt to be more verbally able on average than lower-income families, and they are apt to pass this advantage on to their offspring. In addition to this hereditary advantage, the more income the parents have the more environmental advantages the children will tend to enjoy. The smaller (greater) the income of the parents, other things being equal, the less (more) time they have to spend with their children and stimulate their mental development. Moreover, the smaller (greater) the income of the parents, the less (more) they can afford to invest in their children's mental development in the form of books, toys, nurses, and tutors. Consequently, due to both the environmental and hereditary influences, we expect all the parental income variables including father's education--which again may be more than simply a proxy for income--to be positively related to verbal ability.

Because the amount of time and resources that a family may invest in each of their children varies inversely with the number of children they have, we expect a negative relationship between the number of siblings and verbal ability.

Motivation should also be positively related to verbal ability because more motivated individuals are more likely to learn more and develop their intellectual capacities. In addition to the indirect effect through motivation, per pupil school expenditures may be expected to have a direct positive effect on verbal ability, for at least two reasons. First, in better schools, students are likely, in general, to

be more stimulated and intellectually challenged. Second, as per pupil expenditures increase, the probability that marginal students will receive the special attention and services they need is likely, on average, also to increase.

Finally, age is included in the regression because verbal ability can be expected to increase with age.

C. Years of Schooling

Both motivation and verbal ability should be positively related to years of school completed. Because of the recognized importance of schooling to future economic success and because doing well in school is in itself a mark of success, the more motivated an individual, the more education he will generally attain. The higher the verbal ability the individual has or acquires in school, the better able he is to continue his schooling successfully and the more likely he is to desire to continue his schooling.

In addition to the indirect effects through motivation and verbal ability, parents' income and number of siblings should have direct positive and negative effects, respectively, on school attainment of an individual. The smaller his parent's income and the larger the number of children in the family, the greater will have been the economic pressure on the individual to discontinue schooling and help support the family. Moreover, until recently it was quite difficult to secure loans for financing education. Under these circumstances the ability of parents to finance the direct costs of education--particularly higher education--was a very important determinant of whether or not the individual

continued his schooling. Finally, it is also possible that tastes for schooling vary directly with income. Those with greater tastes for schooling are likely to imbue their offspring with the same tastes. In particular, the father's education variable is likely to reflect a taste as well as an income effect.

Per pupil expenditures should have direct positive effects on school attainment as well as the indirect effects through motivation and IQ. Other things being equal, the better the quality of schooling the more enjoyable and more financially rewarding it is likely to be. Moreover, there should also be a positive relationship because the ability to complete--let alone do well in--the more advanced years of school depends upon what was learned in previous grades--which in turn should depend on the quality of the school. Finally, once again, the probability that marginal students will get the attention and special services that they need to remain in school should increase with per pupil expenditures.

Age is included in the educational attainment regression to capture the secular increase in years of schooling completed. It is assumed that, all else equal, more recent generations are completing more years of education.

Finally, these are at least two reasons for expecting those raised in a city to complete more years of school. First, school expenditures on average are likely to be higher in cities. In part, therefore, the city variable is a proxy for school expenditures. This proxy relationship is likely to hold because of the use of the statewide expenditures data. To the extent that the city variable is a proxy for school expenditures, its inclusion in the regression will lead us to underestimate the importance

of school expenditures on school attendance. Second, in the past at least, opportunities for attending school were probably substantially higher and transportation costs were substantially lower in urban than in rural areas.

D. Wage Rates and Earnings

A significant deficiency in all previous studies with which we are familiar is due to availability of only one year of earnings data for the individuals analyzed. Many individuals in any one-year cross-section will be earning positive or negative transitory income, the presence of which tends to cast doubt on the validity of estimated relationships. Our data include information for two years. We use a five-year average for both earnings and wage rates. In order to obtain a dependent variable approximating normal values, as opposed to measures values in any specific year.

Both per hour and annual earnings may be expected to depend on motivation, verbal ability, and years of schooling. The more achievement oriented an individual, other things being equal, the greater should be his economic achievement. Individuals with higher verbal ability and more years of schooling are, on average, going to have more marketable abilities than those with lower verbal ability and fewer years of schooling. In addition to their indirect effects through motivation, verbal ability, and educational attainment, both income of parents and per pupil expenditures may be expected to have direct effects on earnings.

Frequently parents through their own work and social contacts help their children obtain jobs. The more high paying a job the parent has, the more high paying a job he is likely to be able to find for his children.

Through this social contact mechanism, therefore, the income advantages of one generation are passed on directly to the next generation.[12]

If motivation, verbal ability, and years of school completed were the only outputs of the educational process that were related to future earnings, there would be no direct relationship between per pupil school expenditures and earnings. It is very likely, however, that the schools produce other abilities and characteristics--in greater or lesser quantities, depending upon the quality of the school--that affect the future earnings of students. Mathematical ability, for example, may be as important as verbal ability. Even more to the point, as the recent literature on achievement tests indicates, to date no good tests of the more specific skills taught in the schools have yet been developed. But the absence of such tests is not an indication that no learning has taken place. Other things being equal--including verbal ability scores and years of school completed--the higher the school expenditures, the greater such learning should be. In turn, increased learning should lead to increased earnings. Perhaps as important, self-confidence is likely to have a positive effect on earnings ability, and, other things being equal, we could hypothesize that the fewer pupils each teacher is responsible for, the better job he (or she) can do in instilling self-confidence in each student. Finally, to the extent that error is involved in the measurement of motivation and verbal ability, the per pupil school expenditure variable is likely to capture some of the indirect effect via motivation and verbal ability of school expenditures on earnings. For all of these reasons, we hypothesize that, even after controlling for motivation, verbal ability, and years of school completed, per pupil school expenditures will be positively related to earnings.

Because our society is primarily an urban one, individuals raised in a city should be acculturated to an urban environment and should, therefore, do better financially. However, as noted above, school expenditures are also likely to have been higher in urban than in rural areas. As a consequence, the inclusion of the CITY variable may lead to a negative bias in the school expenditure coefficient.

Finally, in addition to these variables, years of labor market experience should be positively related to earnings. In order to test the linearity of the relationship, we have also included the variable $EXPER^2$, experienced squared. Moreover, to the extent that formal training and on the job training are complements, there should be a positive multiplicative effect of years of schooling and labor market experience on earnings.

IV. SOME ALTERNATIVE MODELS

One serious potential problem with the Basic Model is that the per pupil school expenditure variable may be inappropriately reflecting the influence of some unmeasured variable on achievement orientation, verbal ability, years of schooling, and earnings.

One possibility is that per pupil school expenditure is incorrectly reflecting the effects of the parents' and community's income on the future earnings of the individual. We have already noted that our measures of parents' income is far from perfect. The income measure derived from the father's occupation, for example, is a national average and will not reflect differences across states in the average earnings within the same occupation.

Moreover, the three income strata are almost certainly too crude to capture such cross-sectional differences. On the other hand, the father's education variable will capture some of these differences in the average earnings of given occupations across states. To the extent that these differences are an important element of total differences in earnings and are not captured by the father's education variable, the school expenditures coefficients in the Basic Model may be too high because school expenditures are positively related to differences in incomes across states. In the absence of a variable that accurately measures such differences, the school expenditure variable will reflect the positive effects of parents' income as well as school expenditures on achievement orientation, verbal ability, years of schooling, and earnings.

Similarly, to the extent that (1) the income of the community in which one grows up and goes to school and (2) the income of one's parents have a direct positive effect on motivation, verbal ability, years of schooling, and future earnings, in the absence of a variable to reflect the effect of community income on these variables, the school expenditure coefficient will tend to be too high. Coleman (1966), for example, has argued that the community's income is important because of its effect through peer group influence, that is, the richer and more stimulating are the classmates of a child from a poor family are, the better he will do.

Finally, the positive relationship between school expenditures and future earnings may reflect nothing more than a correlation between the two, attributable to the persistence of geographical differences in standards of living over time. That is, many individual remains in the state where

they grew up. States with higher than average standards of living in 1940, will have had higher than average school expenditures in 1940 and higher than average wage rates in the 1950 and 1960s. If the school expenditure coefficient is simply reflecting this kind of relationship, the addition of the per capita income variable should enable us to untangle the relationship.

In order to test the strength of our results from Model I, therefore, we estimate a variation of the model in which we include the variable per capita income of the state in which the respondent grew up (PCY).[13]

A second potential problem with the basic model is that earnings are not deflated by area differences in the cost of living. The extent to which it is appropriate or inappropriate to deflate earnings by a cost-of-living index depends on (1) whether the school expenditure coefficients are used to calculate social or individual rates of return, (2) the extent to which differences in wage rates and the cost of living between areas are attributable to location rents or compensating differentials, and (3) the extent to which goods and services are sold in national vis-a-vis local markets.

To simplify the discussion, we assume that there are only two areas: one urban, the other rural. In practice most of the variation in the cost-of-living index is probably attributable to factors related to city size. We assume throughout the discussion that money wages are higher in the urban than in the rural area because, ceteris paribus, the close presence of other factors of production in the city makes production there more efficient. Thus the marginal product of identical labor is higher in the urban than in the rural area.

Assume for the moment that there are no disamenities associated with urban residence and that all individuals are indifferent between urban and rural living. In this case only the higher cost of living in the urban area will prevent added migration to the city. Furthermore, assume that all of the difference in the cost of living can be attributed to the higher location rents in the urban area. Workers will continue to move in and bid up the value of locations until costs of living in the city reach the level necessary to offset the value of higher earnings due to greater productivity. Now imagine an individual who is indifferent between locating in the urban and rural area because the higher wage rate that he can command in the urban area is exactly offset by the higher cost of living in the urban area. If he works in the urban area rather than the rural area, however, GNP and social welfare will be higher because, by construction, the value of his marginal physical product is higher in the urban area. But the worker doesn't capture this gain. Rather it is transferred via the higher rent to landlords. Thus in this case it is inappropriate to deflate the differences in earnings between urban and rural workers by a cost-of-living index if we desire to calculate a social rate of return. However, for individual returns we must deflate because higher monetary earnings in the city do not reflect greater welfare for the wage earners.

Now consider a second case. Assume that location rents are identical in the urban and rural areas and that either there are disamenities to urban residence or that, ceteris paribus, all individuals prefer rural to urban residence. Moreover, assume that the urban and rural areas are completely self-sufficient and that there is no trade between them.

Finally, assume that there are no taxes in the system. In this model the differences in the cost of living between the urban and rural area will reflect perfectly the differences in the wage structures between the two areas. Now imagine a worker who is indifferent between working in the urban and rural areas because the higher wage rate in the urban area is exactly offset by the disutility of urban life. If he works in the urban rather than the rural area, GNP will be higher but social welfare will not be higher because the extra output that he produces is offset by the disutility that he derives from urban life. In this case, therefore, it is appropriate to deflate earnings by the cost-of-living index for both the social and individual rate of return calculations.[14]

Finally, consider a case that is identical to the second except that all goods and services are sold on national rather than local markets. In this case there are no differences in the cost of living between urban and rural areas. But because of the disamentities of urban residence, wage rates must be higher there. Again, while GNP is higher if the marginal worker chooses to reside and work in the urban area, social welfare is not higher because the increase in output is exactly offset by the decrease in utility from living in the urban area. In this case, it is appropriate to deflate the differences in earnings in calculating both the individual and social rate of returns. But, by construction, the cost of living is identical in the two areas. Consequently, in this case of cost-of-living index would not be the appropriate deflator. The appropriate deflator is the compensating differential in wage rates--the differential that would make the worker equally happy in or out of the city.

In reality, of course, location rents do vary with city size. Moreover, there may be disamenities associated with urban residence that lead to compensating variations in the wage rate. Finally, some goods and services produced in both urban and rural areas are sold on national markets while others are sold only in local markets. Because it is impossible to ascertain on an a priori basis the relative importance of location rents vis-a-vis the potential disamenities of urban life, we estimate two models in addition to the basic model: one with earnings deflated by a cost-of-living index, and another in which in addition to deflating earnings by a cost-of-living index, we add local wage rate and population size (city size) variables to capture any compensating variations in wage rates that are not reflected in the cost-of-living index. (The city size variable is included to pick up any systematic variation in wage rates by city size that the crude area wage rate variable fails to capture.)

The school expenditure coefficients taken from regressions where earnings are undeflated gives an upper bound estimate of the social rate-of-return corresponding to the assumption that there are no disamenities to urban residence. Coefficients taken from regressions where earnings are deflated by the cost-of-living index give an upper bound to the individual rate of return, while coefficients taken from regressions where earnings are deflated and variables for area wage rates and population are included give a lower bound estimate for both the social and individual rates-of-return corresponding to the assumptions that location rents are identical in urban and rural areas and that wage rates differ because of compensation for disamenities. Given the unlikelihood that the real world situation approximates the conditions necessary for either of these models

to be valid, we assume that social and individual rates-of-return fall somewhere between the estimates of minima and maxima obtained from our models.

V. RESULTS FOR BASIC MODEL

The coefficients and t-values in parentheses are presented in Tables 1 through 4. The results are discussed regression by regression.

A. Achievement Orientation

As evidenced by the low R^2 values, the ability of our model to explain variance in achievement orientation or motivation is not great. Only for the total black sample (R^2 = .15) do we explain as much as 10 percent of the variation. The explanatory variables that are significantly different from zero on the basis of the t test for at least one of the four samples are income-of-father, education-of-father, school expenditures, and farmer-father. The father's income variable is significant and positive for all four samples, while the farmer variable is positive and significant for every sample except total white. Additional father's education adds to motivation for all whites but reduces it for all blacks. Additional father's education (below 12 grades) is not a significant explanatory variable for either of the poor samples. (It is significant and negative for poor blacks at the .05 level.)

Neither the middle-class-dummy variable nor the upper-class-dummy variable has a coefficient significantly different from zero, probably indicating that the other two variables adequately capture the effect of income on achievement orientation. While the number of siblings is

TABLE 1

Coefficients and t-values (in parentheses) from Basic Model for Whites

Independent Variable	ACHIEVE	VERAB	EDYEARS	LNAVWR	LNAVEARN
FATHINC	.006 (3.19)	.0003 (2.45)	.0005 (2.56)	.00002 (0.76)	.00001 (0.39)
FATHED	.0957 (2.90)	.0863 (4.00)	.1080 (2.98)	.0072 (1.54)	.0049 (0.98)
UPINC	-.1695 (0.52)	.3707 (1.73)	1.471 (4.14)	.0272 (0.59)	.0210 (0.42)
MIDINC	.1660 (0.78)	.2081 (1.50)	.7758 (3.37)	-.0549 (1.86)	-.0458 (1.44)
FARMER	.5071 (1.47)	.3947 (1.74)	1.0960 (2.88)	-.0376 (0.77)	-.0268 (0.51)
SIBS	.0635 (1.50)	-.1083 (3.93)	-.2221 (4.80)		
CITY			.3110 (1.28)	.1088 (3.49)	.1127 (3.34)
AGE		.0369 (3.24)	.0107 (0.55)		
LNSCHEXP	.5511 (1.94)	.6618 (2.81)	1.255 (3.11)	.2589 (4.98)	.2038 (3.64)
ACHIEVE		.1157 (4.73)	.2527 (6.14)	-.0020 (0.36)	.0008 (0.14)
VERAB			.3988 (6.39)	.0332 (4.06)	.0329 (3.73)
EDYEARS				.1352 (7.79)	.1328 (7.09)
EXPER				.0925 (4.96)	.0965 (4.80)
$EXPER^2$				-.0009 (3.48)	-.0011 (3.78)
EDEXP				-.0025 (3.99)	-.0023 (3.43)
WKSICK					-.0581 (6.08)
R^2	.06	.16	.33	.37	.38

Sample Size = 716

TABLE 2

Coefficients and t-values (in parentheses) from Basic Model for Blacks

Independent Variable	ACHIEVE	VERAB	EDYEARS	LNAVWR	LNAVEARN
FATHINC	.0019 (6.86)	-.0003 (0.96)	.0009 (2.33)	.00003 (0.78)	.00003 (0.45)
FATHED	-.1278 (2.92)	.0815 (1.89)	.0735 (1.18)	.0143 (2.11)	.0063 (0.70)
UPINC	.0826 (0.19)	.1119 (0.26)	1.2690 (2.08)	.1424 (2.13)	.1566 (1.75)
MIDINC	.2226 (0.55)	-.0217 (0.06)	1.6350 (2.89)	.0599 (9.96)	.0238 (0.28)
FARMER	1.5014 (3.92)	-.6260 (1.64)	.5514 (0.99)	.0545 (0.90)	.0919 (1.15)
SIBS	-.0013 (0.02)	-.0385 (0.76)	.0668 (0.91)		
CITY			1.028 (2.03)	.0203 (0.37)	-.0102 (0.14)
AGE		.0257 (1.15)	-.1238 (3.85)		
LNSCHEXP	.2115 (1.25)	.5614 (2.70)	.8096 (2.61)	.1451 (4.28)	.2129 (4.70)
ACHIEVE		.1903 (3.53)	.1465 (1.86)	.0145 (1.69)	.0261 (2.29)
VERAB			.3719 (4.52)	.0255 (2.77)	.0423 (3.46)
EDYEARS				.1087 (3.49)	.1109 (2.69)
EXPER				.0582 (1.91)	.0698 (1.73)
$EXPER^2$				-.0005 (1.21)	-.0007 (1.23)
EDEXP				-.0024 (2.28)	-.0018 (1.35)
WKSICK					-.0898 (5.82)
R^2	.15	.10	.36	.33	.36

Sample Size = 333

TABLE 3

Coefficients and t-values (in parentheses) from Basic Model for Poor Whites

Independent Variable	ACHIEVE	VERAB	EDYEARS	LNAVWR	LNAVEARN
FATHINC	.0011 (3.28)	.0001 (0.43)	.0010 (2.71)	.00002 (0.39)	.00003 (0.61)
FATHED	.0666 (0.81)	.1003 (1.81)	.2646 (2.92)	.0205 (1.89)	.0177 (1.65)
FARMER	1.4596 (2.73)	.3058 (0.81)	2.1579 (3.53)	.0181 (0.24)	.0408 (0.56)
SIBS	-.0169 (0.27)	-.1631 (3.80)	-.1939 (2.71)		
CITY			.6958 (1.61)	.1564 (3.04)	.1440 (2.82)
AGE		.0451 (2.35)	.0237 (0.73)		
LNSCHEXP	.9843 (2.24)	.8735 (2.35)	2.0173 (3.21)	.1613 (2.13)	.14801 (1.97)
ACHIEVE		.1733 (4.51)	.2528 (3.92)	-.0028 (0.37)	-.0053 (.69)
VERAB			.3111 (3.36)	.0341 (3.10)	.0342 (3.15)
EDYEARS				.1183 (4.09)	.1003 (3.50)
EXPER				.0779 (2.55)	.0664 (2.20)
$EXPER^2$				-.0008 (1.84)	-.0007 (1.75)
EDEXP				-.0019 (1.93)	-.0013 (1.29)
WKSICK					-.0610 (6.23)
R^2	.05	.15	.28	.37	.44

Sample Size = 315

TABLE 4

Coefficients and t-values (in parentheses) from Basic Model for Poor Blacks

Independent Variable	ACHIEVE	VERAB	EDYEARS	LNAVWR	LNAVEARN
FATHINC	.0019 (4.45)	-.0001 (0.25)	.0005 (0.75)	-.00004 (0.59)	-.00003 (0.36)
FATHED	-.1182 (1.72)	.1525 (2.24)	.1145 (1.14)	.0293 (2.66)	.0338 (2.35)
FARMER	1.4891 (3.05)	-.5278 (1.05)	.4639 (0.63)	.0234 (0.29)	.1111 (1.06)
SIBS	.0066 (0.10)	-.0069 (0.11)	-.0295 (0.31)		
CITY			1.1111 (1.63)	.0628 (0.84)	-.0109 (0.11)
AGE		.0325 (1.05)	-.1525 (3.29)		
LNSCHEXP	.1100 (0.53)	.2664 (0.96)	.7310 (1.73)	.1412 (3.04)	.1883 (3.12)
ACHIEVE		.1779 (2.63)	.0557 (0.56)	.0405 (3.66)	.0379 (2.61)
VERAB			.4237 (4.08)	.0199 (1.68)	.0425 (2.76)
EDYEARS				.0726 (1.70)	.1108 (2.00)
EXPER				.0377 (0.96)	.0668 (1.32)
$EXPER^2$				-.0003 (0.60)	-.0007 (0.98)
EDEXP				-.0012 (0.88)	-.0021 (1.17)
WKSICK					-.0464 (1.78)
R^2	.09	.09	.30	.29	.30

Sample Size = 218

negatively related to the achievement orientation of whites, the relationship is not statistically significant at the .05 level and the relationship among blacks is actually slightly positive, though also completely insignificant. These results suggest that the extent to which parents can successfully impart their values to their children does not depend on the number of children they have.

Added school expenditures appear to increase motivation for both samples of whites but are not significant determinants of motivation for either group of blacks. The difference is puzzling.

B. Verbal Ability

Our equation for explaining verbal ability is only slightly more successful than its counterpart for motivation. Again, however, the variables that are and are not statistically significant for the various samples are of interest. Our equation for the total white sample is successful to the extent that all the variables included except the upper-income and middle-income dummies and the farmer dummy are significantly different from zero and have the hypothesized signs. (Farmer and upper and middle income all have positive signs and t-values of 1.5 or greater.) This result suggests that for the total white population verbal ability is positively related to father's income, father's education level, age, motivation, and the quality of education received, and negatively related to the number of brothers and sisters an individual had. With less assurance it could also be suggested that, ceteris paribus, children of farmers and upper and middle income parents have attained greater verbal ability.

The total black sample differs most noticeably from the total white in that father's income, number of siblings, and age are not statistically

significant independent variables. It is possible that the relative weakness or absence of these relationships among blacks is due to discrimination and the residues of slavery. That is, because of past and present discrimination many blacks with high actual or potential verbal ability are likely to have low incomes even relative to other blacks. Chance is likely to play a bigger role in determining income. In this case, to the extent that verbal ability is hereditary, father's income will be a poorer proxy for father's verbal ability for blacks than for whites. In addition, it is possible that for blacks income has only an indirect effect on verbal ability via achievement orientation.

The results for the two poor samples show very similar patterns to their respective total samples. The main differences are that father's income is insignificant for whites from poor families while the school quality variables is not significant for poor blacks.

Our most important results concerning verbal ability are that, except for the one exception of a low t-value for school expenditures for poor blacks, both school expenditures and motivation are positively related to verbal ability for all four samples, and are statistically significant. The magnitude of the effect, however, is small. For an average student in each sample a 100 percent increase in school expenditures per year ($306 for whites, $172 for blacks, $279 for poor white, and $155 for poor blacks) would raise verbal ability scores by only 6.5 percent and 6.9 percent for whites and blacks respectively and 9.1 percent and 3.3 percent for poor whites and blacks.

C. Years of Schooling

The R^2s for our years-of-schooling equations in the four subsamples vary from .28 to .36. This relationship, therefore, appears to be modeled much more effectively than are the previous two. For the total white sample all variables except raised-in-a-city and age are significant and of the expected sign. As expected, achievement orientation and verbal ability are positively related to years of school completed. (Again, this result may be interpreted with caution because causation may in part be in the opposite direction.) For the total black group, however, the coefficients on farmer, father's education, and siblings are not statistically significant and motivation is only marginally significant. Also contrary to the white result, CITY has a significant positive effect and AGE is significant and negative. That older blacks got fewer years of education is certainly not a surprising result.

For the two poor samples the results are again similar to the respective total sample results. The only notable differences are that for poor blacks achievement orientation (motivation) and father's income are not significant and school expenditures are only marginally significant ($t = 1.73$).

The school expenditure variable is significant and positive in both of the white and in the total black equations. The magnitudes of this effect is somewhat more impressive. A 100 percent increase in school expenditures per year could be expected to raise education completed by 10.6 percent and 9.3 percent for whites and black respectively, and by 18.9 percent and 8.6 percent for poor whites and blacks.

D. Earnings

The model also explains a respectable (for micro data) proportion of the variance in earnings. When verbal ability and years of schooling are held constant for both white samples, none of the parent income variables have significant direct effects on either hourly or annual earnings. (Father's education is marginally significant in the poor white result.) In the hourly earnings equations from the black samples, however, both the father's education and the upper income dummy variables have a statistically significant positive effect on earnings. While whites who grew up in a city do substantially better than whites who grew up in a town or rural area, there is no significant difference among blacks. The reason for this racial divergence between the results is puzzling.

Achievement orientation is not significantly related to earnings for whites, but is significantly related to the hourly earnings of total blacks at the .10 level and to their annual earnings at the .025 level. For poor family blacks, it is highly significant and positive for both wages and earnings. It may be that in order to overcome the handicaps of discrimination successful blacks have had to be extremely achievement oriented. Another possibility is that blacks who succeed in the face of discrimination adopt the achievement orientation value system with a vengence while blacks that are less successful are more prone than whites to reject this value system.

The verbal ability scores of both blacks and whites are positively related to their earnings. But whereas the white coefficients are nearly identical in the hourly and annual earnings equations, the black coefficients in the annual earnings equations are quite large relative to the ones in the hourly earnings equations. These results indicate that verbal ability has an effect on the hours worked of blacks but not on the hours worked of whites.

The most likely explanation of this difference is that blacks with very low verbal abilities experience far greater difficulty in securing and/or holding a job than whites.

Years of schooling and years of experience are, as expected, positively related to the earnings of both blacks and whites. (Note that the experience variable for blacks is not statistically significant at the .05 level, nor is the education years variable in the wage equation for poor blacks.) The black coefficients are generally smaller than those for whites, indicating that black earnings increase less than white earnings with increases in years of schooling and experience. The fact that the black education times experience and experience squared coefficients are less negative than the comparable white coefficients (and often insignificant), however, somewhat reduces the difference.

Not surprisingly, weeks of work missed due to illness is negatively related to the annual earnings of both blacks and whites.

Finally, school expenditures in the state where the individual grew up is statistically significant at high confidence levels and positively related to both the hourly and annual earnings of both samples of both blacks and whites. While for whites the coefficient in the annual earnings equation is somewhat smaller than that in the hourly earnings equation, for blacks, the reverse is true. In any case, even the smallest coefficient--in the poor black hourly earnings equation--is quite large. This coefficient suggests that a 100 percent increase in school expenditures would lead to a 14 percent increase in hourly wage rates. Thus, even after controlling for the indirect effects through motivation, verbal ability, and years of schooling,

school expenditures have a large and statistically significant positive effect on earnings.

VI. RESULTS FOR ALTERNATIVE MODELS

As noted above, the school expenditure variable may be a proxy for some other variable such as state per capita income. In Table 5, we present the school expenditure coefficients from regressions that are identical to those presented in Table 1 through 4 except that the per capita income (PCY) variable is added. In addition, we reproduce the school expenditure coefficients from Tables 1 through 4 to facilitate comparison.

The addition of the PCY variable to the ACHIEVE, VERAB, and EDYEARS equations in every case either reduces the coefficient on school expenditures drastically or causes it to become insignificant. It must be noted, however, that in the twelve equations run for these three dependent variables for the four samples, the t-value on the per capita income coefficient is only as large as 1.00 in two cases: 1.33 in the poor white achievement equation and 1.92 in the black verbal ability equation. As can be noted from Table 5, the coefficient on school expenditures exceeds 1.0 in five of the twelve instances including in all four subsamples for years of education. To interpret these findings as evidence that it is per capita income rather than school expenditures that matters would, therefore, be quite risky. Rather the high degree of co-linearity between school expenditures and per capita income makes it difficult to interpret the results.

In the wage rate and earnings equations the results are not nearly so difficult to interpret. For the two black samples per capita income attains

TABLE 5

Per Pupil Expenditure Coefficients (Log Form) and
t-value (in parentheses) from
Regressions With and Without Per Capita Income

	Without Per Capita Income	With Per Capita Income	Without Per Capita Income	With Per Capita Income
	Whites		Blacks	
ACHIEVE	.5511 (1.93)	.0261 (0.04)	.2115 (1.25)	-.0463 (0.13)
VERAB	.6618 (2.81)	.2384 (0.51)	.5614 (2.70)	-.0359 (0.10)
EDYEARS	1.255 (3.11)	1.0242 (1.32)	.8096 (2.61)	.6767 (1.26)
LNAVWR	.2589 (4.98)	.1676 (1.62)	.1451 (4.28)	.1528 (2.55)
LNAVEARN	.2038 (3.64)	.1800 (1.61)	.2129 (4.70)	.2030 (2.55)
	Poor Whites		Poor Blacks	
ACHIEVE	.9843 (2.24)	-.2163 (0.22)	.1100 (0.53)	-.0064 (0.01)
VERAB	.8735 (2.35)	.9905 (1.36)	.2664 (0.96)	.1175 (0.24)
EDYEARS	2.0173 (3.21)	1.3356 (1.13)	.7310 (1.73)	.7783 (1.11)
LNAVWR	.1613 (2.13)	-.0293 (0.21)	.1412 (3.04)	.1712 (2.22)
LNAVEARN	.1480 (1.97)	.0018 (0.01)	.1883 (3.12)	.1771 (1.75)

a t no greater than .15 in the four equations, while the t values for the school expenditure coefficients are 1.75, 2.22, 2.55, and 2.55. The results for blacks lend no support to the hypothesis that school expenditures are serving as a proxy for per capita income. It is also notable that the addition of per capita income hardly changes the school expenditure coefficient in the earnings equations and actually increases it in both wage rate equations.

For the total white sample a similar result occurs. The coefficients are slightly lower but remain high. The t-values, however, are reduced sufficiently so the coefficients are significantly different from zero at only about the .06 level. Again, however, it must be noted that per capita income is not significant in these equations at any reasonable level (t = 1.02 for wage rate and 0.25 for earnings). These results also tend to cast doubt on the proxy hypothesis.

For the poor white sample, however, the results on wages and earnings follow a different pattern. The t-values on per capita income are 1.58 for wages and 1.22 for earnings, compared to -.21 and .01 for school expenditures. Therefore, while neither coefficient is significantly different from zero in the poor white equations, the per capita income variable appears to have a stronger relationship to wages and earnings. There is, therefore, a small hint here that school expenditures may be to some extent a proxy for per capita income of state of youth for poor whites. Because this sample is made up only of children of poor parents, it would seem that either peer or geographic differences would have to be the causal factors if this were the true relationship in the poor white model.

While the addition of the PCY variable generally reduces the estimated indirect effects of school expenditures on earnings, the addition of these variables has very little effect on the estimates of the direct effects of school expenditures on earnings. As will be seen in the next section, the total rate of return to increased school expenditures depends almost exclusively on the direct effect. Thus, the addition of the PCY variable has little effect on the estimated social rate of return to per pupil school expenditures.

The effect of simultaneously adding the PCY variable and deflating earnings by a cost-of-living index, however, is substantial. In Table 6 we present school expenditure coefficients from the basic model, a deflated earnings model, a model with deflated earnings plus an area wage rate and city size variables, and finally a model with deflated earnings plus area wage rate city size and per capita income variables.

In general, both the coefficients on school expenditures and their significance levels decrease as we move from nondeflated to deflated to deflated plus area wage, city size, and per capita income equations. For poor whites deflating by cost of living renders the coefficients insignificant while for total whites they lose significance only after the addition of the other normalizing variables. Perhaps most importantly, however, even the inclusion of the area wage rate and per capita income variables does not cause the school expenditure coefficients to change by great amounts for either black sample, and with one exception the coefficients remain highly significant. For the total white sample in the most extreme equation, the coefficients indicate elasticities of .08 and .10, but the standard errors are more than twice as large as the coefficients, and for

TABLE 6

Per Pupil Expenditure Coefficients (Log Form) and t-values (in parentheses) from Deflated and Undeflated Earnings Regressions

	Undeflated Earnings	Deflated Earnings	Deflated Earnings Plus Area Wage and City Size	Delfated Earnings Plus City Size Area Wage and PCY
			Total Whites	
LNAVWR	.2589 (4.98)	.1777 (3.47)	.1039 (2.00)	.0847 (0.85)
LNAVEARN	.2038 (3.64)	.1227 (2.21)	.0600 (1.07)	.1047 (0.95)
			Total Blacks	
LNAVWR	.1451 (4.28)	.1277 (3.91)	.0907 (2.81)	.1259 (2.25)
LNAVEARN	.2129 (4.70)	.1959 (4.45)	.1519 (3.44)	.1729 (2.28)
			Poor Whites	
LNAVWR	.1613 (2.13)	.0736 (0.99)	-.0093 (0.12)	-.1392 (1.01)
LNAVEARN	.1480 (1.97)	.0601 (0.81)	-.0130 (0.17)	-.0969 (0.70)
			Poor Blacks	
LNAVWR	.1412 (3.04)	.1248 (2.78)	.0829 (1.85)	.1713 (2.37)
LNAVEARN	.1883 (3.12)	.1718 (2.90)	.1275 (2.13)	.1752 (1.79)

the poor white sample the coefficients actually become negative (though not significant).

Thus, if the model that embodies the most pessimistic assumptions is accepted it is not possible to reject the hypothesis that for whites the direct individual and social rate-of-return to school expenditures is zero. In marked contrast, the differences between the coefficients from the deflated and undeflated earnings regressions is much smaller for blacks. Moreover with one exception all of the coefficients are statistically significant at the .05 level or better. Thus even if one accepts the most pessmistic assumptions, it is possible to reject at the .05 level the hypothesis that higher per pupil school expenditures do not lead to higher earnings for blacks.

VII. RATES-OF-RETURN

From the results reported in sections V and VI it is possible to calculate rates-of-return to increases in educational expenditures. In order to calculate rates-of-return we assume that individuals begin school at age six, begin work immediately after leaving school, and continue working until they reach age 64. In estimating rates-of-return from the hourly wage rate equations, we also assume that individuals work 2000 hours every year of their working life. Given these assumptions, the coefficients of the independent variables in the hourly and annual earnings equations together with values for these variables will generate lifetime earnings streams. The initial earnings streams are derived from evaluating the two equations for the mean values of all the independent variables. Then school expenditures are

increased by 10 percent, and all of the other endogenous variables in the model change by their school expenditure coefficient times 10. In this way a second school expenditure and earnings stream is generated. The second is subtracted from the first for each year and then the following equation is solved for r:

$$(5)\quad PV = \frac{Y_6}{1+r} + \frac{Y_7}{(1+r)^2} + \ldots + \frac{Y_{64}}{(1+r)}\,58 = 0,$$

where

PV = present value,

Y_m = difference in either school expenditures or earnings or both in the nth year of the individual's live, and

r = rate of return.

The income values from the first (Y_6) through the last year of school are, of course, negative due to the simulated increase in school expenditures without any immediate increase in earnings. Added to the negative effect during school years are the forgone earnings incurred by being in school rather than working.

In Table 7 we present upper and lower bound estimates for whites and blacks of the social rate-of-return to increasing school expenditures. The upper bound estimates are derived from the school expenditure coefficients of the basic model. The lower bound estimates are derived from the school expenditure coefficients in deflated earnings regressions that include the area wage city size and PCY variables. In addition to the total estimated rate-of-return, we present the estimated rate-of-return attributable only to the direct effects of school expenditures on earnings.

TABLE 7

Maximum and Minimum Estimates of the Rate-of-Return to Increased School Expenditure

	Maximum Estimate (from Basic Model)		Minimum Estimate (from Model with Deflated Earnings Plus Area Wage Rate and Per Capita Income)	
	Hourly Earnings	Annual Earnings	Hourly Earnings	Annual Earnings
	Total Whites			
Total effect	14	14	9	10
Direct effect	15	14	9	10
	Total Blacks			
Total effect	15	18	13	13
Direct effect	18	20	17	19
	Poor Whites			
Total effect	12	12	[a]	[a]
Direct effect	13	14	[a]	[a]
	Poor Blacks			
Total effect	15	19	15	13
Direct effect	20	21	24	22

[a]Rate of return is negative.

Estimated total rates-of-return to whites range from 9 to 14 percent, while those for blacks range from 13 percent to 18 percent. Even the lower bound estimates for total whites are somewhat respectable given the non-financial benefits that are likely to flow from increases in the quality of education. (On the other hand, recall that these estimates are derived from coefficients that were not significantly different from zero at the .05 level.) The estimates of the rate-of-return to increasing school expenditures for blacks are uniformly high. Only the lower bound estimates for poor whites--which are negative--are low.

Two other comments on the results in Table 7 might be useful. First, note that the rate-of-return estimates attributable only to the direct effects of school expenditures are normally larger than the total rate-of-return estimates. This is because an indirect effect of increasing school expenditures is to increase the number of years of schooling. This increases the cost of increased expenditures by the amount of forgone earnings. It also postpones the flow of benefits and reduces the number of years during which benefits will accrue. On the other hand, of course, wage rates also increase by virtue of the additional years of schooling. Empirically, however, the rate-of-return to increased years of schooling turns out to be lower than that for increased school expenditures, so that including the indirect effect reduces the estimated total rate of return.

Second, note that the rate-of-return for blacks is uniformly higher than that of whites in spite of the fact that many of the black school expenditure coefficients were smaller than those of whites. The reason for this puzzling result is that blacks have a much lower mean years of

schooling. Hence they begin to accrue benefits from increased school expenditures sooner than whites and by construction have more years in which to accrue benefits.

VIII. A CAUTIONARY NOTE

In a fully specified model, school expenditure should have no direct effect on earnings. Increases in the quality of schooling should lead to increases in cognitive or other kinds of abilities that lead to increases in earnings. The fact that school expenditures are directly related to earnings even after we control for achievement orientation, verbal ability, and years of schooling is disturbing. The regression coefficients suggest that larger school expenditures lead to higher earnings, but we do not know through what mechanism. For policy purposes, it would be preferable to be able to race the causal chain more completely.

The same criticism, of course, applies to the effect of years of schooling on earnings; in fact, it is this criticism that has made the human capital models so vulnerable to the criticism that an extra year of schooling leads to increased earnings, not because it increases the skill level of the individual, but rather because it creates an arbitrary ranking of individuals for job slots out of what would otherwise be a more random assignment. While higher school expenditures cannot serve the labeling function that more years of school completed does, the fact that we do not know the mechanism through which increased expenditures leads to increased earnings suggests that (1) despite our results we

ought to remain somewhat skeptical and (2) we ought to attempt to discover the link between expenditures and earnings in order to ascertain the most efficient way of using increased expenditures to increase earnings.

IX. SUMMARY

In this paper, we have estimated a range of rates-of-return to increasing per pupil school expenditures. We have argued that it is impossible to specify on a priori grounds the correct regression model from which these rates-of-returns must be estimated. As a consequence we estimated several alternative models. Our results indicate that the rate-of-return to all whites is quite respectable irrespective of the model used. For poor whites, on the other hand, the estimated rate-of-return from the model which incorporates the most pessimistic assumptions is actually negative. Finally, irrespective of the model used, the rate-of-return to increasing school expenditures for all blacks and just poor blacks is very high.

FOOTNOTES

[1]There are also obviously many nonmonetary returns to education, both for the individual and society. The abilities to read, write, converse, enjoy music and art, vote intelligently, and live in harmony with other people may be enhanced to varying degrees by education. Obviously such returns to the education process are of great import even though they cannot be well measured in economic terms. We ignore these nonmonetary returns with full knowledge of their possible importance. The data and methodology for their measurement simply do not exist. Our rate of return estimates are undoubtedly biased downward by the exclusion of such returns.

[2]The cities were Baltimore, Boston, Brooklyn, Chicago, Cincinatti, Cleveland, Detroit, Gary, Milwaukee, Newark, Philadelphia, Pittsburgh, San Francisco, St. Louis, District of Columbia, and two "white" suburbs of Detroit and Cleveland.

[3]See John B. Lansing and James N. Morgan, "The Effect of Geographic Mobility on Income," The Journal of Human Resources 2 (Fall 1967): 449-60; Lowell E. Gallaway, "The Effect of Geographic Labor Mobility on Income: A Brief Comment," The Journal of Human Resources 4 (Winter 1969): 103-109; and "The Effect of Geographic and Industry Mobility on Income: A Further Comment," The Journal of Human Resources 4 (Fall 1971): 525-27.

[4]The self-employed are excluded because of the impossibility of separating the returns to labor from the returns to capital for this group.

[5]Poor people, particularly blacks, were oversampled in the Michigan Survey. In our regressions, therefore, we weighted the observations with the weights required to blow the sample up to national representativeness.

[6]The local wage rate was obtained from estimates by local employment service officials. The cost-of-living index is for the 39 largest SMSAs in the country. Individuals residing outside of the 39 largest SMSAs are assigned either the metropolitan or nonmetropolitan cost-of-living index for the region in which they live.

[7]In a very small number of cases the individual whose earnings we are examining did not take either the achievement orientation or verbal ability test. Individuals who did not take the tests were assigned the mean score. A dummy variable equal to 1 for individuals who did not take the tests was insignificant in all equations and was therefore dropped from the models discussed in the text.

[8]We are grateful to John Bishop for supplying us with this index.

[9]In the data used, years of school completed were given in intervals--e.g., 9-11 years. The midpoints of the intervals were used to convert the variable to a continuous one.

[10]An individual must possess the following three characteristics to be classified as poor. He must answer that his parents were poor, that his father had less than a high school education, and that his father was not a professional, nor a manager, nor a self-employed person. Slightly less than 1/2 of the white sample and 2/3 of the black sample qualified for classification as poor. We believe the results for these two subsamples to be representative of children of families from the bottom part of the income distribution.

[11]The direction of causation between achievement orientation and earnings, and by implication the direction of causation between achievement orientation and years of school completed is not entirely one way. The same may be said of the direction of causation between verbal ability and years of school completed and even verbal ability and earnings. To the extent that the relationships just enumerated are simultaneous in nature--i.e., that higher verbal ability leads to more years of schooling and vice versa--our results may be biased. The fact that family background variables, such as income, affect achievement orientation and verbal ability suggests that, at least in part, some of these attributes precede any schooling. In order to test the sensitivity of our results to the order of causation between achievement orientation, verbal ability, and years of schooling, we estimated rates-of-return to per pupil school expenditures from a model in which increases in school expenditure affect achievement motivation and verbal ability only through increasing years of schooling. We found that though the indirect effects of education expenditure on earnings through achievement orientation and years of schooling changed a bit, the differences were quite small. Similarly, dropping the verbal ability measure from the model had little effect on the total rate-of-return estimates reported in the next section. As a consequence results from these alternative models are not discussed in the text.

[12]The number of siblings is irrelevant in this context. We did try adding the number-of-siblings variable to the equation (4) and found that the coefficient was completely insignificant.

[13]Some researchers have used a born-in-the-South dummy variable in attempting to capture such effects and also as a possible proxy for differences in tastes for education across regions. We tested such a model and found the results to be similar to those using the per capita income variable. The per capita income variable, however, had a much stronger effect in reducing both the coefficients and t-values on the education expenditure variables.

[14]It may be the case, however, that many inframarginal urban workers place a positive value on city residence. Because wages are higher due to disamenities for marginal workers, those workers who receive positive benefits from city life will receive real earnings greater than money earnings deflated by cost of living. Deflated earnings figures may underestimate individual and social rates-of-return if such individuals are an important factor in the total urban work force. Of course, the analogous effect could be hypothesized for rural dwellers. The amenities of rural life for the marginal rural dweller may be significantly less than those for other rural residents.

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